

SCIENCE.

FRIDAY, MARCH 19, 1886.

COMMENT AND CRITICISM.

'THE GEOLOGY of the Pittsburgh coal-region' is the title of an interesting paper, recently published, by Professor Lesley. The amount of coal in the Pittsburgh region is estimated at about thirty billion tons, — an amount practically inexhaustible, at least for centuries. During 1884, eleven million tons were taken from the Pittsburgh bed, — an output of about sixty per cent of the whole bituminous coal-production of the state, and about thirty-three per cent of the shipments of anthracite. Concerning oil and gas, however, the author has very different views. He says, "I take the opportunity to express my opinion in the strongest terms, that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is nevertheless, not only geologically but historically, a temporary and vanishing phenomenon — one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject."

THE CORNELL UNIVERSITY REGISTER for 1885-86, which has just appeared, shows an institution in a high state of efficiency. There are upwards of 60 professors, assistants, instructors, and similar officers, and 638 students. Of this number, 604 are undergraduates; and the marked difference in numbers between the upper and lower classes may be taken as evidence of the rapidly increasing popularity and efficiency of the university. As against 84 seniors and 97 juniors, there are 162 sophomores and 239 freshmen. The former figures are those of Amherst, Williams, and Brown, while the latter are not far away from those of Harvard. That this magnificent increase is due to a liberal policy and the judicious use of a large endowment, cannot for a moment be doubted; but it seems strange to find in this great university so important a department as that of political economy represented by an associate professor only, and the whole instruction in philosophy

devolving upon one man. We are aware that Professor Schumann has been called to this department at Cornell, and will begin his work next autumn; but at that time Professor Wilson will, we understand, retire from active duty, and philosophy will yet have but a single representative. The rapidly widening provinces of psychology and ethics have long since made it impossible for a man who must also teach the history of philosophy and logic to keep up with their progress; and it is strange that so few of our great colleges seem to recognize this fact. Harvard and Princeton seem to us the only two colleges in which the philosophical encyclopaedia is at all adequately represented.

BOTANICAL INSTRUCTION IN THIS COUNTRY.

By a slow evolutionary process, botanical instruction appears to be undergoing a radical change in the United States, which concerns both its nature and methods. Whereas only a few years ago botany, as a college study, dealt chiefly with the flowering plants and vascular cryptogams, its scope has broadened, even in the limited undergraduate curriculum, so that the graduate of to-day is supposed to have been taught more or less about each of the principal groups of plants, from the lowest to the highest, if he has studied botany at all. With this change has come an earnest effort to make his knowledge a working-knowledge, obtained in the laboratory so far as essentials are concerned, and merely rounded out in the lecture-room. That Harvard university should be prominent in planning and introducing these changes is not surprising, for nowhere has botanical research and instruction been so favored in the possession of the necessary means and of talented leaders in different branches of the growing subject.

A good library and herbarium form an admirable basis for much systematic work and for a certain class of instruction, but they must needs be supplemented by a garden and museum if the latter is to meet the modern requirements. Botanical gardens are established either to aid in the introduction of valuable economic plants, or as

means of education. Several of the largest gardens owe their origin primarily to the first cause, though they have proved valuable educational agents, and may ultimately have come to be used chiefly for instruction and research; but a considerable number are the property of colleges, and were from the first intended to subserve educational ends. The garden at Cambridge is of this class; and the report of its director, just published, shows that it is growing in usefulness. Beside the general collection of plants that every well-regulated garden is supposed to contain, the Cambridge garden is working toward extensive special collections to illustrate economic botany and the general morphology of phenogams. The groups in the latter, which can well be copied on a smaller scale, even where the name of 'botanic garden' would appear pretentious, are arranged in substantially the order laid down in the common text-books of botany, so that the different forms of leaves, flower-clusters, and flowers, can be easily recognized by any pupil. In connection with the economic plants—intended to exhibit variation under domestication by large suites of varieties of such plants as the cabbage, etc., and to promote the cultivation of vegetables that have come to be prized in Europe, though strangers to our tables—should be mentioned the large economic collection of trees in the Arnold arboretum at Jamiaca Plain, which is now reported by its director, Dr. Sargent, to be definitely planned so as to include a general collection of the native trees of eastern Massachusetts, and the most valuable species from other localities, planted singly, to admit of the maximum growth of each species, and also in groups, chosen so as to represent its main varieties, and calculated to show its mass-characters. This loosely planted general collection, arranged for the definite purpose of object-teaching, is supplemented by a more compact experimental and working collection, intended to supply material for study, and especially to receive doubtfully hardy or valuable species and transitory horticultural forms.

While Harvard—the oldest and strongest botanical centre of the country—is thus giving evidence of large resources and progressive intelligence, the fact that similar steps are taking in other sections of the country is not to be overlooked, and is even more indicative of progress, since it implies a wide-spread interest in better instruction and better research in botany. It is very desirable that this feeling may become more

prevalent, and receive the financial backing that is necessary if it is to count for much.

So far as experimental work is concerned, persons who know that there is a botanic garden at Washington, enjoying the patronage of the government, might expect much from it, did not the majority of them know, at the same time, that it is so circumstanced as to improve its past record very little until the policy of its management is radically changed. Until then, such work must be done elsewhere; and it is being undertaken by the experiment-stations and agricultural colleges of several states enthusiastically, if, in most cases, with too limited resources. Meantime new gardens are being established and developed under hopeful auspices. The most prominent of these are the newly created Montreal garden, and the private garden of Mr. Henry Shaw of St. Louis, which has recently been placed in relation with the chair of botany of Washington university, and will, it is understood, be so amply endowed by its founder as to become within a few years, if properly developed, a leading centre for research, experiment, and instruction in pure and applied botany.

That these movements indicate a growing recognition of the needs of botany and a disposition to meet them, is suggested by rumors of similar steps soon to be taken in other quarters; so that the outlook for botanical and horticultural work of a high grade is more promising than at any time in the past. What is most to be feared, is that ill-advised influence may place the facilities for this work in incompetent hands, with the result not only of temporary delay, but of permanent disaster. This danger can be avoided only by proper care in the first instance, both in selecting men and in planning work.

DEEP-SEA SOUNDINGS IN THE SOUTH PACIFIC.

THE navy department has received a letter from Commander A. S. Barker, U.S.N., dated Dec. 18, 1885, at Sandy Point, Magellan Straits, in which he reports having made a series of deep-sea soundings from Wellington, New Zealand, across the South Pacific to the Straits of Magellan. Fifty-seven casts were taken during the passage, from Nov. 6 to Dec. 16, over a distance of forty-five hundred nautical miles. The passage was made across that part of the ocean where strong westerly winds prevail, and many of the soundings were taken under trying circumstances. A few gales were encountered, but only one severe

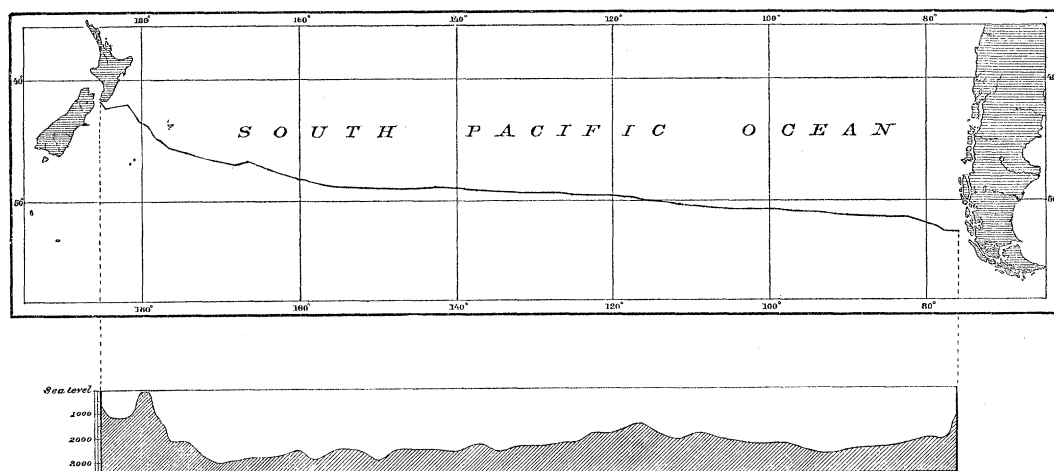
storm; and not a single cast was missed, from 180° west to the Straits.

The sounding-machine used was Sigsbee's improvement on Thomson's, and was mounted on the starboard end of the bridge, which is just forward of the smokestack. The soundings were taken head to sea, the wind a little on starboard bow; the ship was easily kept in this position by spanker, main topsail, and by working the engines slowly. The seas were too heavy to sound stern to wind, as was done by the *Tuscarora* when she did such excellent work under Commander Belknap.

This line of soundings, running as it does very close to the ice-limit, was chosen by the hydrographic office with a view of completing for the

gation. The energies of the hydrographic office should be directed to clearing up the paths of commerce by searching for reported dangers, and this can only be done thoroughly by means of deep-sea soundings. The scientific consideration of the ocean-bed will naturally follow.

This line of soundings of Commander Barker would seem to show that the main bed of the South Pacific commences just south of Chatham Island, the depth increasing very rapidly for the first 300 miles, until 3,002 fathoms is reached, in longitude 170° west. Beyond this point the profile shows no remarkable irregularities except in longitude 150° west, where there is a depth of 2,915 fathoms, with 2,650 fathoms and 2,506 fathoms on each side. From longitude 135° west



DEEP-SEA SOUNDINGS BY THE U. S. S. ENTERPRISE.

From Wellington, New Zealand, across the South Pacific to the Straits of Magellan.

present the deep-sea survey of the lower South Pacific.

In 1875 the *Challenger* ran a line of soundings in about 40° south latitude. Between this and the line run by the *Enterprise*, the German ship *Gazelle*, in 1875, also executed a series of soundings, with somewhat greater intervals between than those of the two lines already mentioned. These three series give a fair idea of the general depths in this part of the Pacific, and will probably be sufficient for all purposes for some time to come. North of the *Challenger's* line, however, over the entire Pacific, lines of soundings should be run in all directions, and at short distances apart; and the hydrographic office has laid out a plan by means of which this can be done from time to time, by our war ships, most economically and effectively, to accomplish the practical result of determining the existence of dangers to navi-

the depths decrease quite regularly until 118° west is reached, where the least depth, 1,562 fathoms, was found. Beyond this the depths increase again quite regularly to the base of the continent.

This rise in the ocean-bed would point to the possible existence of a ridge running generally north and south, and limited, as far as known, by Easter Island, in latitude 27° 09' south, longitude 109° 25' west, and Dougherty or Keates Island in latitude 59° 21' south, and longitude 119° 07' west. This ridge is also indicated by a sounding of 1,600 fathoms, taken by the *Challenger* in latitude 38° 43' south, longitude 112° 31' west.

The lines of soundings taken by the *Challenger* and the *Gazelle* from 100° to 150° west run generally parallel to that of the *Enterprise*, and show a remarkable uniformity in the depths along the same meridian in the belt of the South Pacific, between latitude 40° and 50° south.

The surface temperatures agree with the results of previous observations for the same seasons and latitudes. It is to be regretted that no temperatures below the surface were obtainable, on account of the absence of deep-sea thermometers; but as the *Enterprise* is a cruising ship of war, and is not fitted especially for this kind of work, Commander Barker and the officers are deserving of great commendation for the valuable results accomplished. When the specimens of the bottom arrive, they will be sent to the Smithsonian institution for examination and discussion.

J. R. BARTLETT.

U. S. hydrographic office, March 8.

THE DISTRIBUTION OF RAINFALL IN NEW ENGLAND, FEB. 10-14, 1886.

THE rainstorm which occurred in the eastern part of the United States between the 10th and 14th of February of the present year was very severe in the southern part of New England. The amount of rain surpassed that of any preceding storm on record in that portion of New England where it was the greatest. In addition, there was a large quantity of snow and ice upon the ground, which was melted, and swelled the amount of water pouring into the rivers, thus causing most disastrous floods.

The meteorological conditions which attended this remarkable rainstorm are deserving of attention. On the morning of Feb. 11, the pressure in the eastern part of the United States was unusually high. At Anticosti Island the barometer (reduced to sea-level) indicated 30.01 inches; in New England the pressure ranged from 30.9 inches on the eastern border, to 30.6 on the western; while a trough of relatively low pressure, 30.0 inches, extended from the Gulf of Mexico to the lake region. Light rains were falling along the eastern front of this trough in the central states, heavy rains upon the Middle Atlantic coast, and the storm was just beginning in New England. During the day a centre of depression gradually developed in the central states, and the pressure began to fall. The fall was very rapid on the 12th; and on the morning of the 13th the pressure ranged from 29.8 to 29.6 inches in New England, with the centre of the depression, 29.45 inches, over Lake Ontario. During the 13th the storm-centre advanced rapidly down the St. Lawrence valley, but the rainfall had ceased to be excessive. On the 12th, the day on which the greatest rainfall was noted, the pressure conditions were peculiar. A careful charting of the barometric observations made by the U. S. signal service shows that in the morning

a well-developed centre of low pressure existed in Indiana, moving northerly. In the afternoon a secondary depression formed on the Atlantic coast, which at ten P.M. was central at Washington. At seven A.M. of the 13th but one centre existed,—over Lake Ontario. The heaviest rainfall, therefore, occurred simultaneously with the development of a secondary barometric depression, south-west of New England. In its development the barometer fell rapidly. Between seven A.M. of the 12th and seven A.M. of the 13th, the fall was 0.54 of an inch at New York, 0.57 at New London, and 0.60 at Boston.

No peculiarities were noted in the other conditions. The temperature remained very nearly stationary during the 11th and 12th at a few degrees above the freezing-point, but rose on the night of the 12th and the morning of the 13th to above 50° F.

The region covered by the greatest rainfall includes the states of Connecticut, Rhode Island, and the eastern portion of Massachusetts. As there are many observers of rainfall in this region, it has been possible to determine the distribution of the rainfall with considerable approach to accuracy. The special reports collected by the New England meteorological society from one hundred and thirty-two observers show, that, in a region covering more than one-half of Rhode Island and the south-eastern part of Connecticut, over eight inches of rain fell. The amount diminishes rapidly west and east of this region, about two and one-half inches having fallen on Cape Cod, and less than one inch in the north-western part of Massachusetts. The region of heaviest rainfall is situated about two hundred miles north-east of the position of the centre of barometric depression on the afternoon of the 12th.

In order to give a general idea of the extent of territory covered by the rainfall, the following estimate has been made by the help of the accompanying map. The estimate includes the land-surface only.

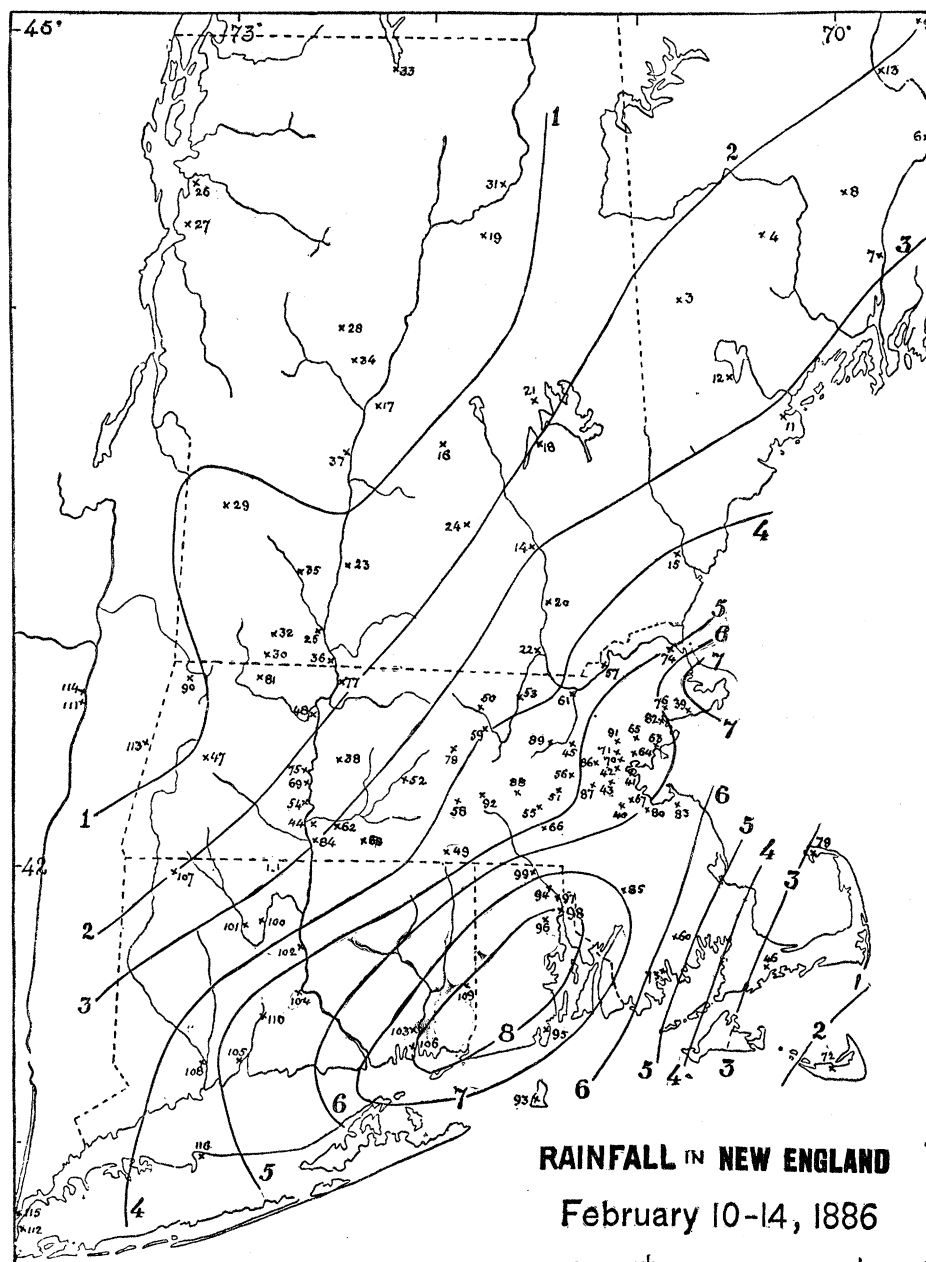
Amount of rainfall.	Area in square miles.
Over 8 inches	750
Between 7 and 8 inches.....	750
“ 6 “ 7 “	1,500
“ 5 “ 6 “	1,850
“ 4 “ 5 “	2,750

The above embraces about five-ninths of the total area of the states of Massachusetts, Rhode

Island, and Connecticut. If we assume that the rainfall increased uniformly within the limits of this area, the total amount of water which fell

report of Desmond Fitz Gerald, C.E., referring to the Boston water-works :—

“The water passing over our lowest dam in the



from the clouds upon this portion of New England exceeded 750,000,000,000 gallons. In this connection the following may be quoted from the

first four days (12th-15th) was 5,120,000,000 gallons, the equivalent of four inches of rain over the whole watershed. The maximum flow was

on the 13th, viz., 2,000,000,000 gallons in twenty-four hours, on seventy-eight square miles of watershed. We have no records showing a greater amount: the nearest approach was March 26, 1876, when the freshet was nearly as great."

The form of precipitation was almost wholly rain, a little snow or hail having occurred at its beginning at a few places only. The rainfall was nearly continuous for about two days and a half, but was not of equal severity. Indeed, the greater part of the fall occurred in twenty-four hours, as is indicated by the following table, which contains the times of beginning and ending of the rain, the total amount, and the amount during a specified interval of twenty-four hours. Similar records could be given from many other stations.

Station.	Time of beginning.	Time of ending.	Total Rainfall.	Interval of 24 hours during heaviest rainfall.	Rainfall in 24 hours.
			Inches.		Inches.
New York.....	11th, 10.30 A.M.	13th, noon	3.41	11th, 11.00 A.M. to 12th, 11.00 A.M.	2.99
New London	11th, 6.00 A.M.	13th, 4.20 P.M.	8.93	11th, 11.00 P.M. " 12th, 11.00 P.M.	6.66
Providence.....	11th, 1.00 A.M.	13th, 11.30 P.M.	8.13	12th, 7.00 A.M. " 13th, 7.00 A.M.	5.65
Boston	11th, 7.45 A.M.	13th, 2.45 P.M.	5.62	11th, 11.00 P.M. " 12th, 11.00 P.M.	4.45
Newburyport.....	10th, 5.30 P.M.	13th, 10.30 P.M.	4.78	11th, 9.00 P.M. " 12th, 9.00 P.M.	3.30

The immense amount of water which thus fell in a few hours was of itself amply sufficient to cause disastrous freshets, but it was largely augmented by the snow and ice on the ground. The depth of the snow at the beginning of the rain has been variously estimated. In a few places there was none on the ground, but in the greater part of the region it was found to a depth of from two to fifteen inches. This was wholly melted, and added to the rain as it forced its way over the frozen ground to the rivers. The amount thus added can only be conjectured; for the snow was in many places quite compact, and at the ground there was a thick layer of ice. Several persons have independently estimated that the equivalent of two inches of water was obtained from the snow and ice. This estimate is not excessive, and may be adopted for the region where the rainfall was greatest.

An amount of water, therefore, exceeding ten inches in depth in the maximum area, sought the streams and caused their overflow, with disastrous results. No attempt need be made to estimate the damage to railways, public highways, manufactories, and private property, the details of which

were duly chronicled by the daily press; but it is worthy of note, that, from the geographical position of the flooded region, the damage was confined to a relatively small area. The rivers were affected only near their mouths, while a similar rainfall in the northern portion of New England would have caused wide-spread destruction.

The meteorological records of former years have been consulted for similar instances of excessive rainfall. At Providence, which is in the area of maximum rainfall, there are continuous records since 1832, kept until 1876 by the late Rev. Dr. Caswell, and since that time by the city engineer. There is no instance on record of a rainfall of eight inches, though one exceeding seven inches was noted in July, 1834; and during the week March 20-26, 1876, the amount of 7.66 inches

was recorded. It is probably safe to say that in Rhode Island no rainfall has been heretofore recorded of so large amount in a single storm, but there may be records of equally severe storms in other parts of New England; and one which occurred in Connecticut Oct. 3 and 4, 1869, was still more severe.¹ In this storm there were reported at Hartford 8.43, Colebrook 8.44, Middletown 9.37, and Canton 12.35 inches.

The following table contains the total amounts recorded by observers who have kindly responded to the request for their observations. The accompanying map contains the lines of equal rainfall drawn from the observations. The numbers upon the map correspond with those of the several stations in the table. It was found impracticable to print the amount of rainfall at each station on account of the small size of the map. The lines have been drawn freely, and do not follow closely every individual record. In charting rainfall records, which depend so largely upon the location of gauges and the local topography, this is impossible; but it will be seen, from a comparison

¹ See paper by James B. Francis, C.E., in Transactions of the American society of engineers, August, 1878.

of the values of the table with the lines upon the map, that in this case the individual records are quite fairly represented.

Station.	Rainfall.	Station.	Rainfall.
NEW BRUNSWICK.			
1 St. John.....	2.46	58.....	3.50
MAINE.			
2 Bar Harbor, <i>a</i>	3.50	59 Long Plain.....	5.88
3 Bridgeton.....	3.70	60 Lowell, <i>a</i>	4.36
4 Buckfield.....	2.40	61 Lowell, <i>b</i>	4.54
5 Eastport.....	2.75	62 Ludlow.....	2.78
6 Fairfield.....	1.54	63 Lynn.....	5.68
7 Gardiner.....	2.51	64 Medford.....	5.58
8 Kent's Hill.....	3.27	65 Meriden.....	5.60
9 Mayfield.....	2.47	66 Milford.....	4.04
10 Orono.....	2.05	67 Milton.....	5.60
11 Portland.....	3.07	68 Monson.....	3.80
12 Sebago Lake.....	2.38	69 Mount Nonotuck.....	2.31
13 Solon.....	1.65	70 Mystic Lake.....	5.64
NEW HAMPSHIRE.			
14 Concord.....	2.80	71 Mystic station.....	5.11
15 Dover.....	3.50	72 Nantucket.....	1.82
16 Grafton.....	1.08	73 New Bedford.....	4.51
17 Hanover.....	0.67	74 Newburyport.....	4.78
18 Lake Village.....	2.40	75 Northampton.....	2.46
19 Littleton.....	2.46	76 North Bereny.....	7.66
20 Manchester, <i>a</i>	3.47	77 Northfield.....	1.71
21 Manchester, <i>b</i>	3.65	78 Princeton.....	4.07
22 Meredith Centre.....	1.75	79 Provincetown.....	2.65
23 Nashua.....	3.71	80 Quincy.....	5.54
24 Walpole.....	1.12	81 Rowe.....	0.70
25 Warner.....	1.95	82 Salem.....	6.21
VERMONT.			
26 Brattleboro.....	1.57	83 South Hingham.....	6.51
27 Burlington.....	0.33	84 Springfield.....	2.97
28 Charlotte.....	0.60	85 Taunton, <i>a</i>	6.83
29 Chelsea.....	0.99	86 Taunton, <i>b</i>	6.53
30 Dorset.....	1.12	87 Taunton, <i>c</i>	6.91
31 Jacksonville.....	1.61	88 Waltham.....	6.08
32 Lunenburg.....	0.35	89 Wellesley.....	5.70
33 Marlborough.....	1.39	90 Westborough.....	4.63
34 Newport.....	0.71	91 Westvale.....	4.93
35 Stratford.....	0.90	92 Williamstown.....	0.99
36 Townshend.....	1.41	93 Winchester.....	5.45
37 Vernon.....	1.50	94 Worcester, <i>a</i>	4.72
38 Windsor.....	0.95	95 Worcester, <i>b</i>	5.29
MASSACHUSETTS.			
39 Amherst, <i>a</i>	2.66	RHODE ISLAND.	
40 Amherst, <i>b</i>	2.35	96 Block Island.....	6.22
41 Beverly Farms.....	6.60	97 Lonsdale.....	7.69
42 Blue Hill.....	6.13	98 Narragansett Pier ¹	7.95
43 Boston, <i>a</i> ¹	5.62	99 Olneyville.....	8.30
44 Boston, <i>b</i>	5.76	100 Pawtucket, <i>a</i>	7.92
45 Cambridge, <i>a</i>	5.70	101 Providence, <i>b</i>	9.04
46 Cambridge, <i>b</i>	5.63	102 Woonsocket, <i>a</i>	6.74
47 Chestnut Hill.....	6.09	103 Woonsocket, <i>b</i>	6.38
48 Chicopee.....	3.24	CONNECTICUT.	
49 Concord, <i>a</i>	4.90	104 Canton.....	3.08
50 Concord, <i>b</i>	4.59	105 Collinsville.....	5.23
51 Cotuit.....	2.79	106 Hartford, <i>a</i>	4.32
52 Dalton.....	0.50	107 Hartford, <i>b</i>	4.63
53 Deerfield.....	2.06	108 Lake Konomoc.....	6.17
54 Dudley.....	3.88	109 Middletown.....	5.30
55 Fitchburg, <i>a</i>	3.42	110 New Haven ¹	3.84
56 Fitchburg, <i>b</i>	3.52	111 New London ¹	8.93
57 Framingham.....	4.64	112 Norfolk.....	1.68
58 Gilbertville.....	3.38	113 Shelton.....	4.86
59 Groton, <i>a</i>	3.62	114 Volunstown.....	8.00
60 Groton, <i>b</i>	3.54	115 Wallingford.....	5.85
61 Holyoke.....	2.62	NEW YORK.	
62 Hopkinton.....	4.76	116 Albany ¹	0.77
63 Lake Cochituate.....	4.95	117 Brooklyn.....	3.39
64 Lawrence.....	4.31	118 Lebanon Springs.....	0.84
		119 Menands.....	0.57
		120 New York, <i>a</i>	3.41
		121 New York, <i>b</i> ¹	4.10
		122 Setauket.....	4.76

WINSLOW UPTON.

SOME WORK OF THE GOVERNMENT SURVEYS.

THE work of the topographical department of the geological survey during the past fiscal year shows an increase of thirty-nine per cent over that of the previous season, — a result due mainly to the increased experience and efficiency of the men engaged in its prosecution. The following state-

¹ Station of U. S. signal service.

ment presents in brief form the progress made during the past year, the area being given in square miles: Appalachian section, 22,080; Missouri, 20,000; Cascade, 10,400; Texas, 8,000; Arizona, 8,000; Yellowstone Park, 3,600; Gold Belt, 2,400; Massachusetts, 2,500; New Jersey, 1,500; total, 78,480. Of the maps intended to show the topographic survey of the United States, 88,000 miles have already been completed, and the proof-sheets issued, giving the results in Alabama, Missouri, Texas, Utah, and Montana. Additional work of the department, covering 82,000 square miles, is now in the engraver's hands, embracing the following states: Virginia, West Virginia, Tennessee, Missouri, Kansas, New Mexico, Arizona, Utah, and Nevada. The scale of publication of the survey of Massachusetts and New Jersey is about one mile to the inch; in the South Appalachian section, Gold Belt, Yellowstone National Park, Kansas, Missouri, and Texas, two miles; and in Arizona, Oregon, and northern California, four miles. The draughtsmen of the office have been mainly employed upon work of the originally compiled map of the United States, and the compilation of the map of New York to serve as a basis for the geologic map.

Major Powell has just received a collection of objects illustrating the character of the Oraibi Indians of north-eastern Arizona, consisting of ancient pottery, war-clubs, ancient clothing, musical instruments, and the wooden implements used by them in making fire in connection with their religious rites. There is also a large collection of bone, horn, and stone implements, among the last being many fetiches and carved animals employed in their religious ceremonies. There are also several objects used by these Indians in their marriage and funeral rites, the uses of which have been previously unknown. The material gathered is especially valuable and interesting, as so little is known of these Indian tribes who were first visited by Major Powell about ten years ago.

In the archeological investigations in the south-west, about the ruins of Cañon de Chelly in Arizona, among the curious things unearthed by an exploring party of the geological survey were several fragmentary ears of corn, with one complete and well-developed ear. The latter was found in a grave with a mummified child. It resembles a common ear of red corn, although somewhat smaller; and the grains, even at the present time, are well developed, and fit closely over the entire cob. The antiquity of this corn can be determined as far back as six hundred years. The ruins in which the corn was found are in the same state of preservation as they were when Coronado first visited this country in 1540.

The traditions of the present tribes, as well as the archeological evidences in connection with its discovery, all attest its great antiquity. As corn is supposed to be a native of this continent, its discovery under these peculiar circumstances will aid in throwing considerable light on its origin and history.

HEALTH OF NEW YORK DURING FEBRUARY.

ON the opposite page will be found a graphic representation of the daily mortality in the city of New York for the month of February, together with certain meteorological data for the same period. The deaths are those from all causes, those from a few of the prominent causes which are constantly at work in all populous centres, and those of children under five years of age. These statistics are furnished to *Science* through the courtesy of Dr. John T. Nagle, of the board of health. The large number of those who die after having just commenced to live is a striking feature here, as it is in all reports of mortality. That the number is as low as it is, is accounted for by the few deaths which at this season of the year are caused by diarrhoeal affections; for seven days in the month there having been no deaths due to this form of disease, and in eleven days only one death each day, while the highest was but two deaths. When the spring has fairly set in, and the warm days appear, we shall expect to see this condition change, the disease assuming a more prominent place among the death factors, until, during the intense heat of the midsummer, it will overtop them all, and carry off its victims by the scores. Scarlet-fever was, during the month, a little more active as a cause of death than the diarrhoeal diseases; and yet the difference was so slight that the lines representing the mortality from these two affections cross each other repeatedly, and often coincide. Consumption occupies the most prominent position in the diagram, — a disease which has prevailed in all communities for ages, and which has been the subject of as much study and experimental research as, perhaps, any disease which affects the human race, and yet one which still ravages the world, and appears only in a slight degree to be amenable to treatment. Much has been done by sanitarians to point out the influences under which it thrives, and the means to be adopted to lessen its prevalence; and it is more than probable, that, if the advice which has been so freely given were to be put into practice, the number of deaths would be greatly reduced.

The meteorological data are obtained from the

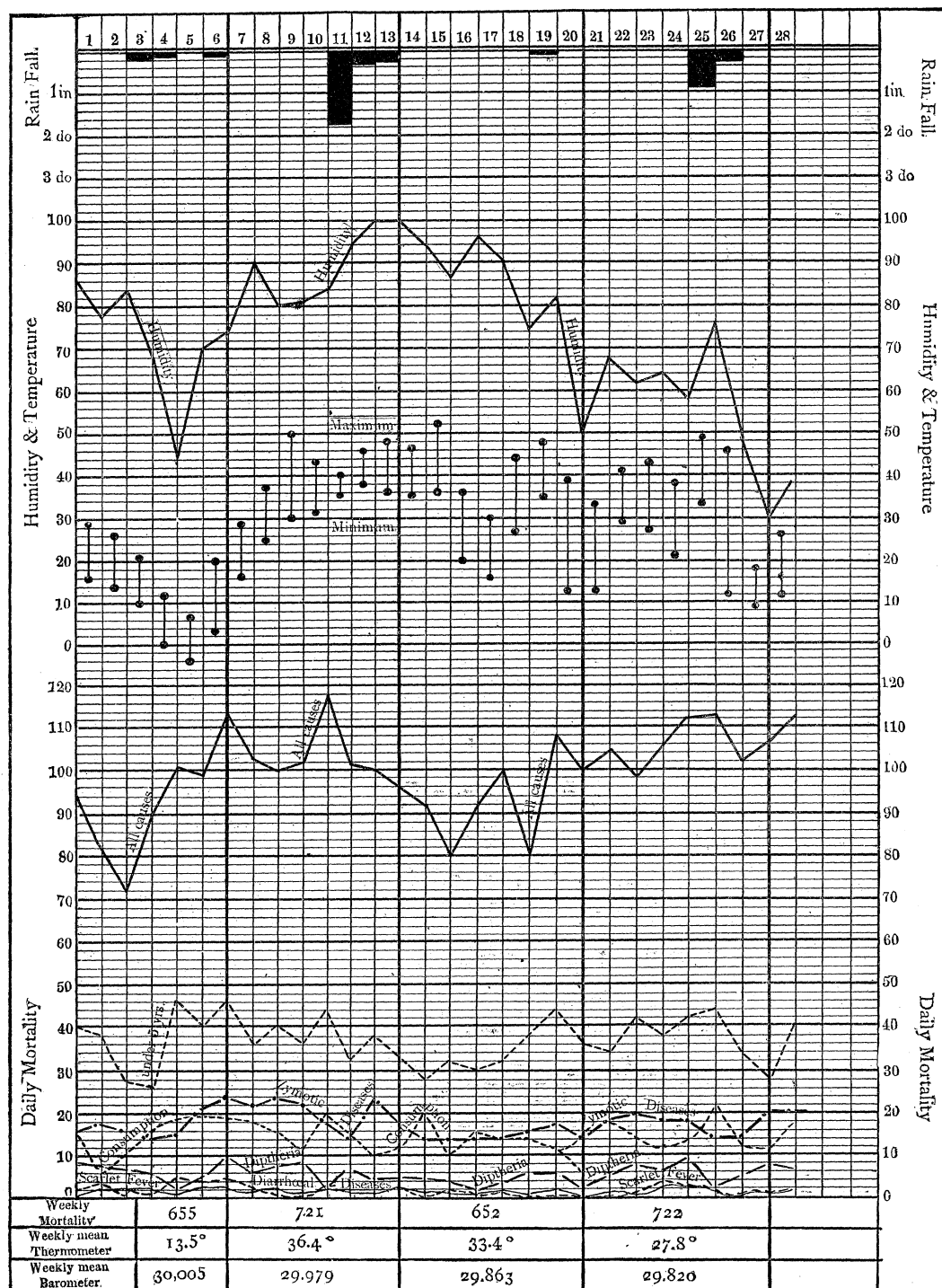
observatory in Central Park, through the kindness of Director Daniel Draper, Ph.D. The instruments from which these observations are made are placed fifty-three feet above the ground, and ninety-seven feet above the sea. The daily mean humidity is obtained from readings taken at seven A.M., two and nine P.M. The 'rainfall' recorded on the 4th as .10 of an inch was in reality 5 inches of snow; the .01 of an inch on the 6th was also snow, which fell to the amount of one-quarter of an inch. These, as is usual, have been reduced to water, and so recorded. February will be remembered as a month in which the thermometer fell to a very low point, -4° F. on the 5th; while on the previous day it was at 0° , and on the 6th but three degrees above that point.

RAILROAD TRANSPORTATION.

MR. HADLEY's book deserves high praise. It is clear, scholarly, well written, well arranged, temperate and impartial, and yet vigorous and outspoken. It supplies a need which Mr. C. F. Adams's book on railroads filled with great, even though incomplete, success, for matters as they stood ten years ago, — the need of a compact discussion of what the railroad problem is, and what it means. It gives a brief history of the growth of the railroad system, points out the problems and evils that are now before us, and discusses the solutions and remedies. There are excellent chapters on the railroad experience of other countries, and abundant references to the literature of the subject. The book may be strongly recommended, both to those who are specially interested in railroads and the railway problem, and to the general reader who wishes to inform himself on one of the most important of public questions. It is much to be wished that studies of this kind should be read, and not only read, but bought. We have by far not enough of intelligent and careful investigation of our industrial and political problems; and it is a regrettable fact that the publication of such investigations has not been found, as a rule, to be profitable to the publishing-houses, not to mention the authors. The growing importance of such questions, the arousing of public attention to them, the increasing number of thoughtful men who wish information, ought to give a widening circle of readers of books like Mr. Hadley's.

The most important conclusion which the reader who approaches the problem through this book will reach — the conclusion which enforces itself on anyone who gives intelligent study to the sub-

Railroad transportation, its history and its laws. By ARTHUR T. HADLEY. New York, Putnam, 1885. 8°.



ject, but which, unfortunately, has impressed itself but little on the public mind—is, that there is no one solution of the railroad problem, and no one remedy for the evils which exist. The problem is a vast and complicated one: in truth, there is not any one problem. There are a number of different problems; and it is not the least of the merits of this book that it clearly distinguishes them. Perhaps the best part of the book is the discussion of the most difficult of them all,—the question of railroad-rates. Mr. Hadley makes a plea, unanswerable in its essentials, in favor of the much-maligned and much-abused principle of charging ‘what the traffic will bear.’

Some things we have learned on these problems; but a great deal more must be learned, and learned chiefly from experience, before the railroad system settles down into a permanent form. For example, it is pretty well agreed, even in this land of non-interference, that government regulation in some form is desirable. Almost every state in the union has its railroad commission. But how far public interference shall go, is quite an open question. There are those who believe that it should go far, and that the tendency is and should be toward eventual state ownership and management. German economists have adopted this view pretty generally, and they have followers in this country. They may be right; but experience up to the present time is by no means clear in favor of their view. Mr. Hadley, in his chapters on the railroad experience of European countries, and especially in his concluding chapter on the results of state railroad management, shows that, even in continental Europe, the question of state railroads is by no means settled. Only in Prussia is state management an established fact, and apparently a success. But in Prussia the conditions are peculiarly favorable; and even there the future must be awaited, before we can judge of the system. How far public regulation can go and ought to go in this country, at the present time, is still more an open question. Mr. Hadley evidently believes that a federal railroad commission is pretty sure to come in the future, and believes it to be desirable. But he does not commit himself as to the extent of the powers it should have, although he presents strong reasons for its having, at least at first, only advisory, and not judicial or administrative powers.

In his chapter on competition and combination, Mr. Hadley expresses strongly his opinion that the economic principles which apply to most forms of production and trade do not apply to railroads. In fact, he says that the law of competition, as laid down by Ricardo and his followers, is ‘false in theory,’ so far as railroads are concerned. I

must confess that this seems to me to be overstraining the matter. Whether one considers the theory to be false, depends very much on what is one’s conception of it. Correctly stated, the theory of Ricardo and of ‘orthodox’ economists, simply says that, given such and such premises, such and such conclusions follow. If the premises do not correspond to facts, the theory does not apply. Perhaps it ‘breaks down;’ but does it become ‘false in theory’? No doubt the premises correspond, in important respects, to facts, in a less degree in the case of railroads than in almost any other branch of industry. The theory, then, fails to apply in a corresponding degree, and we must approach the economic problem from other points of view. But Mr. Hadley himself points out that the theory is by no means without its force and application, even in railroad matters. He tells us in one place that, “where the profits of an existing concern are high enough to tempt it, a competitor will come into the field” (p. 103), and refers to the West shore road as a conspicuous instance. And elsewhere he tells us that when the legislature of Wisconsin, by the Potter law, fixed rates at unremunerative figures, railroad construction stopped, facilities on existing roads could not be kept up, and the state was compelled to repeal the law. “The laws of trade could not be violated with impunity” (p. 135). Are not these applications of Ricardian laws, at least after some rough fashion? No doubt we cannot solve all economic problems by these laws, and no doubt, in some directions, the development of industry in modern times requires us to apply them more and more cautiously. But we should not therefore throw them entirely overboard, as if they did not yield us any help at all.

But this is a question which interests chiefly the economic student; and perhaps, after all, it is only a question of choice of language. There is no ground for substantial difference with what Mr. Hadley has to say in his chapter on competition and combination. There, and throughout the book, are the marks of thorough study and clear-headed thinking.

F. W. TAUSSIG.

MINOR BOOK NOTICES.

Reiseerinnerungen aus Algerien und Tunis. Von Dr. W. KOBELT. Frankfurt-am-Main, Diesterweg, 1885. 8°.

It is curious to contrast this ponderous and thoroughly scientific work of a German physician with that of the vivacious Monsieur Melon, which we noticed some time ago,—the one so chatty and superficial, the other so dull and accurate. We read the Frenchman’s book, and cast it away without the slightest thought of ever looking at it

again. We laid Dr. Kobelt's volume aside with the intention of referring to it whenever any thing is wanted concerning Algeria and Tunis. No doubt the Germans have a lack of perspective. To many of them a fact is a fact, to be investigated and recorded; and their books are therefore often wearying in the extreme. But, after all, they do the work. They accomplish results which never have been and never will be accomplished by the French method of grabbing at whatever is picturesque and entertaining, and flinging the rest contemptuously aside. In the present volume the author has done his work conscientiously and well. Portions of it are dreary reading; but there are many interesting chapters. Especially worthy of mention are three chapters on the ethnology of the countries visited, — the eighth, on Algeria and its inhabitants; the eleventh, dealing with the Kabyles; and the twenty-third, on the Tunisians. His route was *via* Marseilles; and the first chapter, describing that city, is one of the very best in the book. In short, American travellers who intend writing up their journeyings would do well to imitate in some measure the methods of Dr. Kobelt. The volume is well illustrated, both with photographs of scenery and of natives. It contains also an appendix of considerable value, by Dr. O. Boettger, describing the reptiles and amphibia collected by the author in North Africa. Besides the lack of an index, the volume is deficient in that it contains no map. This is the more to be regretted, as the learned doctor's route is by no means easy to follow on any but a recent German map of Algeria and Tunis, and recent German maps of those regions are to be found in this country only in our larger libraries.

Römische chronologie. Von L. HOLZAPFEL. Leipzig, Teubner, 1885. 8°.

In his 'Roman chronology' Dr. Holzapfel aims at correcting Roman dates, as commonly given, by a minute process, which, at least as regards the earliest dates, is certainly its own best refutation. He deals also with the various Roman eras in current use among the ancients. Finally, he attempts to give a detailed account of "the course of the Roman calendar down to the time of Caesar's reform." In 1859, Theodor Mommsen, guided by a practical good sense, which Dr. Holzapfel hardly possesses, dealt with all these questions in his 'Roman chronology.' Though in many details Mommsen's conclusions can no longer be accepted, notably as regards the chronological significance of the appointment of a dictator *clavi figendi causa*, it is still true that Mommsen's book is the best upon the subject. The cardinal fault of Dr. Holzapfel's work is, that it is inextricably incomprehensible without the unremitting labor of

constant reference to what has been written by others. The reader is distressed by a needless clatter of controversy, which seems to indicate that Dr. Holzapfel does not sufficiently trust his own conclusions. All who are not actually bearing the brunt of the chronological fray will find this book unrefreshing and confusing; and those who are well read in the whole subject may well pause before tormenting themselves with our author's argumentations. The book is conspicuously lacking in neatness of statement. There is no sense of proportion, no prospective. The 'peasants' calendar' and the business year of ten months are practically ignored. And yet what could be of more importance than the former, in any account of the conditions which made Caesar's reformed calendar a possibility as well as a necessity? It is to be lamented that Dr. Holzapfel could not find time to make his book both shorter and more complete. This 'Roman chronology,' with its tediously paraded controversies and its sophomoric list of emendations, ostentatiously placed at the end, is an overgrown 'doctor's dissertation' rather than a desirable book of reference.

A text-book of inorganic chemistry. By VICTOR VON RICHTER. Authorized translation by Edgar F. Smith. 2d American from the 4th German ed. Philadelphia, Blakiston, 1885. 16°.

THAT Professor Smith's translation of Richter's useful text-book of inorganic chemistry has passed to a second edition, is perhaps sufficient testimony to its value. Much has been rewritten, and some new matter incorporated; but the work would have gained in clearness and smoothness if more attention had been paid to the rendering of the sense, rather than the phraseology, of the original.

Spectrum analysis. By Sir HENRY E. ROSCOE. 4th ed. by the author and by Arthur Schuster, Ph.D., F.R.S. New York, Macmillan, 1886. 8°.

THE fourth edition of Roscoe's 'Lectures on spectrum analysis,' wholly revised, almost wholly rewritten, and including concise accounts of such recent advances of importance in spectroscopy as lend themselves to popular treatment, follows closely the plan and arrangement of its predecessors, and appears in the same elegant guise. The character and scope of the work are too well known to need extended comment.

ST. PETERSBURG LETTER.

ON the 11th of February there was a special meeting of the Geographical society, in honor of N. M. Prjevalsky. The large hall of the Michael palace, where the meeting was held, was crowded by a distinguished audience. In a short preliminary address, the vice-president, P. P. Semenov, spoke of the merits of the traveller, and reminded

his hearers that in his absence this time, Prjevalsky had received two of the highest honors conferred on travellers, — the Vega medal of Sweden, and the gold medal of the Italian geographical society.

It is impossible to see and hear the celebrated traveller without being struck with his fitness to do so difficult and extraordinary a work. With an iron constitution, a rare force of will, the still rarer faculty to command, and communicate his enthusiasm to the picked men who followed him, it was possible for the small band of twenty Russians to explore thousands of miles in the heart of Asia, on the highest plateaus of our globe, amid the greatest hardships and often dangers.

In going to so distant a country and one so difficult to explore, the personal comforts of the travellers had to be sacrificed, their stock of food consisting of *dzamba* (wheat or barley flour roasted) and brick-tea, animal food being furnished by the chase. Their principal baggage consisted of arms and ammunition, as their safety, as well as the success of their zoölogical collections, was dependent upon them. Perhaps the greatest hardship encountered by the expedition was the want of good fuel with which to warm themselves, cook their food, and make tea. The greater part of the countries traversed is treeless, and dried dung the only fuel. This is tolerable in winter, spring, and autumn, when the wind is from the north. Then Thibet is generally dry: but in summer it rains nearly every day, and snows sometimes, and the air is rather humid.

The principal results of this fourth expedition of Prjevalsky consist in an extension of the surveys westward from north-eastern Thibet to countries absolutely unknown. Now they are connected by lines of surveys eastward to Prjevalsky's former road-surveys, northward to Lake Lop-Nor, and westward to the existing Russian and English surveys in Chinese Turkestan. This expedition has proved that very high chains of mountains, with peaks over twenty thousand feet high, rise southward from the lower northern plateaus of high Asia (as Zaidam, the basin of the Tarim, etc.), and that these mountains trend from west to east, there being no meridional chains. There are no large glaciers in the greater part of these mountains, but there are enormous ones on the northern slope of the Kiria chain (so named from the city and oasis at their foot, in Chinese Turkestan).

The annual commencement of the St. Petersburg university was held Feb. 20, in the large university hall. The report was read by Professor Wassiliewsky, and began, as usual, with necrological notes on deceased professors or honorary members of the university. The chief remarks were devoted to the celebrated historian of Russia,

Professor Kostomarow, and to N. W. Kalatschow, an eminent archeologist. Statistical notices followed. The number of students by faculties, was, compared with the last two years —

Year.	Physico-mathematical.		Historico-philological.	Oriental languages.	Law.	Totals.
	Mathe-matical.	Natural sciences.				
1884	534	568	253	57	834	2,246
1885	485	552	263	76	906	2,282
1886	531	437	252	79	981	2,230

It is seen from this table that the university has a large number of students; and this is the more remarkable, since it has no medical faculty, and this faculty in other Russian universities has more than one-third of all the students. The most notable feature of the changes in the last two years is the increase in the number of law students. By far the larger number of Russian students, after passing their examinations, enter the state service; and law studies are preferred, as giving a better opening than the other faculties. The decrease of the students in natural science is caused by the easier admission into the Medico-chirurgical academy and higher technical schools. A few years ago this academy abolished its first two 'courses,' which gave a general preparation in natural sciences, retaining only the last three special courses. Thus the medical students were compelled first to enter one of the Russian universities; and the medical faculty at Moscow, and the section of natural sciences at St. Petersburg, were crowded far beyond their available room and means of their existing museums and laboratories. The return to the old system at the Medico-chirurgical academy, and the somewhat easier admission at some of the technical schools, have freed the university of a great number of such students, to the profit of the others.

Then followed a lecture by Professor Woeikof, "On the cooling of the globe in connection with the distribution of temperatures in the solid crust of the globe and the ocean;" after which the rector, Professor Andreiewsky, mentioned the medals and other marks of distinction received by the students. Besides these, the university awarded one of the Tljenkow premiums of five hundred rubles to P. T. Brounow, for his works on cyclones and anticyclones in Russia, one of which has been printed in the Proceedings of the Geographical society.

It is interesting to mention a feature of Russian

university life which is developed nowhere so much as at St. Petersburg : it is the large number of students who receive 'stipends' (scholarships). About one-fourth of the students (in all, 577) receive regular scholarships ; and, as those of the first year are excluded from them, the percentage is much higher in the three later years. The yearly expenses of the university in 1885 were four hundred and thirty-five thousand rubles.

O. E.

St. Petersburg, Feb. 26.

NOTES AND NEWS.

THE Rev. W. C. Winslow, 429 Beacon Street, Boston, treasurer and vice-president of the Egypt exploration fund for America, writes as follows : "The invaluable labors of our society in the Delta were successfully resumed in December. The splendid results of 1883-84 and 1884-85, for classical, historical, and biblical elucidation and illustration, are familiar to scholars and to a large portion of the reading public. The work is in the hands of masters ; but these labors cannot go on without continued support. To those who contribute so small a sum as five dollars the elaborate memoir of the season, annual reports, etc., are sent. The book 'Naukratis' (forty plates and plans) is in preparation ; 'Tanis II.' (Zoan) will follow. The officers and the committee all give their services gratuitously. To all interested a circular and other information will be gladly furnished by the treasurer."

—The winter habitat of the mackerel is not yet definitely ascertained. It is interesting, therefore, to place upon record the fact, noted in the circular of the Boston fish bureau of March 5, that the schooner Fitz J. Babson of Gloucester was struck by a heavy sea on the 27th of February, when about twenty miles north of Georges Banks. When the water had disappeared, eight mackerel were found flipping about the deck. The spring mackerel fleet is being fitted out somewhat earlier than has been usual in former years, on account of this indication of the proximity of the mackerel schools to the coast.

—A committee of geologists and naturalists invite subscriptions to a monument to Oswald Heer, whose death two years and a half ago closed the work of one of the most eminent naturalists of this century. It will take the form of a marble bust on a stone pedestal, to be placed under cover in the Botanic garden at Zurich. One thousand dollars are desired, and those willing to contribute are invited to send their contributions to Dr. C. Schröter, Professor, Hottingen, Zurich, before the first of May next, or to

the editor of *Science*, 47 Lafayette Place, New York, who will see that they are forwarded.

—Dr. Austin Flint, the most celebrated of American physicians, died in New York, March 13, aged seventy-four. Probably no one person has ever exerted so great an influence in medical education, and in the medical profession of America, as has Dr. Flint through his text-books and teachings.

—Professor Ward's 'Sketch of paleobotany' (Fifth annual report, U.S. geol. surv.) is an excellent work, and one to which the title does not do justice. The work comprises biographical sketches of twenty-two of the most eminent leaders of the science, followed by a 'sketch' of the early history and subsequent progress of paleobotany, which must have involved a large amount of labor. After this follows a discussion of the classification of fossil botany. Between eight and nine thousand species of fossil plants are now known, two of which are from the Cambrian, nearly fifteen hundred from the carboniferous, and over three thousand from the miocene, with only sixty-nine from the trias, and less than four hundred older than the carboniferous. In his introductory remarks upon the inter-relation of geology, paleobotany, and botany, the author expresses surprise that the mutual dependence of botany and paleobotany has received so little recognition among scientific men, and presents the importance of studying fossil and living plants together. Certainly with this view every naturalist ought heartily to concur. What he complains of in fossil botany has been unfortunately too true in other branches of paleontology.

—Mr. Gilbert's report on the 'Topographic features of lake shores,' in the 'Fifth annual report of the geological survey,' is of especial interest from the author's wide experience on the 'fossil' shore-lines of the evaporated lakes of the Great Basin, and from his studies of the former expansion of Lake Ontario, now in progress. The several topographic forms are well defined, and illustrated by maps and views. The plates of the Cup Butte and other portions of the old Bonneville shore-line in Utah are particularly valuable. A large share of shore-work is attributed to the waves and littoral currents of great storms, just as the greater part of river-channel topography is determined by the heavy and exceptional floods. The bars at the western end of Lake Superior are adduced in illustration of the statement that the greatest waves, and not the prevailing winds, of a shore, will define its topography.

—Mr. Westwood Oliver, with the assistance of a number of astronomers, has in preparation a

practical manual of 'Astronomical work for amateurs,' the aim of which will be to help the possessors of limited instrumental means to turn their attention to astronomical researches of real scientific utility, special attention being directed to the comparatively new fields of spectroscopy and celestial photography. The book will be published by Messrs. Longmans & Co. Mr. Oliver, in the mean time, invites suggestions from practical workers, which may be sent to him at Lochwinnoch, Scotland.

— 'The weather journal' (Cincinnati, *S. S. Bassler*) is the title of a new weekly paper to be devoted to the general meteorology of the eastern United States, illustrated by tri-daily charts of the movements of the atmosphere and the distribution of atmospheric pressure and temperature.

— The wealth and richness of the illustrations of Mr. I. C. Russell's 'Recent glaciers of the United States' (Fifth annual report, U. S. geol. surv.) would alone give his work value, but they serve only to embellish what without them is a very interesting treatise. Some of the engravings of Mounts Shasta and Dana are especially striking. One is surprised to learn of the extent to which glaciers occur in the United States throughout the northern Sierra Nevada and Rocky mountains, while in the Cascade Mountains are numerous ones, flowing through narrow defiles and over precipices, and, as the author says, by no means unworthy of comparison with the ice-fields of Switzerland and Scandinavia. In Alaska the catalogue is still further extended, embracing numerous examples of alpine glaciers as magnificent as any in the world.

— Professor Chamberlin's paper, in the 'Fifth annual report of the U. S. geological survey,' on artesian wells, is one that cannot help but be of practical value. It was the author's aim to include in convenient form such information relative to the qualifying conditions of artesian wells as may be capable of brief, general statement, and may seem to be serviceable alike to citizen, driller, and geologist; and he has evidently succeeded.

— Some novel and interesting applications of instantaneous photography to the study of the movements of the heart and intestines have recently been made by Dr. W. G. Thompson. Photographs of rabbits', pigeons', cats', and frogs' hearts were made in different stages of systole and diastole, showing the action more clearly and accurately than is possible by other methods. In addition to the value of such in physiological teaching, the most practical application of the

method will be the illustration of the changes in the form of the heart and intestines produced by drugs; and the author believes the process may be further extended to the study of the contractions of the stomach, bladder, and diaphragm, and other viscera.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The trade in spurious Mexican antiquities.

A NOTE supplementary to my paper on Mexican pottery, published in your issue of Feb. 19, may be of interest to a number of readers.

The fraudulent specimens referred to reach this country in two ways, — through the agency of travellers who purchased them in Mexico, and through traders who ship them to New York in large lots. From recent observations I have reached the conclusion that there are now in the collections of this country specimens valued at many thousands of dollars, yet which, since they are fraudulent and in every way vicious, are not worth the trouble of breaking up and casting away. Peru is hardly less fully represented, as the factories in that country have been at work for a number of years.

The detection of modern work is in many cases a difficult matter, but in others a decision is easily reached. With reference to the Peruvian frauds, it may be taken for granted that new-looking specimens are new, and, besides, that many old-appearing pieces are new. If exterior appearances are not sufficient to satisfy the collector as to the age of suspected pieces, let him break some very narrow-necked vessel, either of the light terra-cotta colored or of the black ware, and he will probably find that the inside is innocent of any stain of age.

I may add that objects of stone from both of these countries need careful inspection.

W. H. HOLMES.

Washington, D.C.

The anachronisms of pictures.

The articles of Professors Holder and Lockwood (*Science*, vii. 220 and 242) remind me of what I saw many years ago in one of the ladies' magazines, — a picture of the embarkation of the Pilgrims from Delft Haven, with steamships at anchor in the bay. An enterprising artist! — only about two hundred years ahead of his time, and the picture probably 'drawn by our artist on the spot.'

C. G.
Homer, N. Y.

Is the dodo an extinct bird?

It is very improbable that the dodo has been found in the Samoan Islands, alive or fossil. It inhabited the islands of Mauritius and Bourbon in the Indian Ocean. The bird alluded to by Mr. Hopkins as still living in Samoa is probably the *Didunculus*, a specimen of which I well remember in the collection of Sir William Jardine, the famous ornithologist. Sir William thought the *Didunculus* was allied to the dodo and the pigeon.

W. S. SYMONDS.

The camp, Sunningdale, Feb. 29.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 19, 1886.

VIEWS OF ECONOMISTS ON THE SILVER PROBLEM.

I.

WHAT laws should congress enact, regulating the coinage of silver at the present juncture? To this question, nakedly put, I am obliged to answer that I do not know. The reason I do not know is, that I am not in possession of the minute knowledge necessary to enable me to give a satisfactory answer to the question. It is extremely necessary to the smooth and orderly course of business that the current dollar, when measured in terms of human labor, should vary as little as possible from year to year and from generation to generation. If we compare the value of the gold in a gold dollar with the value of the silver in a silver dollar, we shall find that the former, instead of being equal to or less than the latter, as it was up to 1873, is twenty-five per cent greater. Taking gold as a standard, the value of the silver in a dollar has fallen twenty per cent. Taking silver as the standard, gold has appreciated twenty-five per cent. If the silver dollar is the least variable one, then silver coinage should be free, provided that the proper quantity of silver is put into the dollar; otherwise gold should be the standard. Thus the first question which meets us is whether the silver or the gold standard is the least variable, when measured in terms of human labor.

Now, this is a question of fact, to be settled, not by speculation or by abstract reasoning, but by a careful and exhaustive analysis of manufactures, prices, wages, and industry, not only in this country, but in the leading countries of the world. Without this analysis, nothing I could say on the subject would be final. It would take me a year, and would require help from a great number of experts, to make the necessary statistical investigation; and I have not the time to do this. When considering the problem, I feel as if on board a ship in a narrow channel, on a dark night, listening to a discussion among the sailors as to whether they shall steer to the right or left. If they ask me what they shall do, I answer, that the only way I see to proceed is to take soundings from point to point until they determine, as nearly as possible, where the middle of the

channel is, and then to follow it as closely as they can.

Have I, then, no impression or views whatever on the subject? I reply, that I have no views so well founded but that I would like better ones before advising action. My impressions I am ready to give, with the proviso that I retain the right to reverse them to-morrow if any new light of a nature to change them is thrown on the subject.

Firstly, to begin with the subject in its more remote and general bearings, I am of opinion that a dollar composed of a fixed weight of either of the precious metals will not serve the purposes of the world's business indefinitely. The increase of wealth must, it seems to me, make gold more valuable, unless the supply is continually increased. Without being able to give an exhaustive investigation of the subject, the impression which I have derived from statistical tables is, that the consumption of gold in the arts the world over is now fully equal to the annual supply, and is continually increasing. If the latter is not increased, the former will speedily exceed it, and then the stock of gold on hand, and available for money, will slowly diminish. The necessary result will be an appreciation harmful to the standard.

Secondly, although I look upon this appreciation as inevitable at some future time, the weight of evidence seems to me to be in favor of the view that it has not yet commenced, or at least has not taken place in a serious degree. It is true that this statement runs counter to the impressions which one derives from tables of prices, and especially from the tables published from time to time by the London *Economist*; but there is a defect in these tables which has not been sufficiently taken account of. The prices are mostly those of metals, grains, and other comparatively raw materials, which are made and sold on a large scale. Now, the production of these staples has been enormously increased in late years by the opening-up of new sources of supply, and the invention of improved methods of extraction and production. Besides, they represent but a small fraction of the total product of human labor. They cannot, therefore, afford us the required basis of comparison.

What we should principally depend upon are those articles in whose production no great improvement has been made. We should also take

them in proportion to the quantities produced or consumed. About a year ago I made an approximate determination of this kind, with the following result: a certain collection of the necessities of life, representing a nearly fixed amount of human labor, had the following values at different periods: ¹—

In 1876 the collection was worth	\$111.66
" 1880 " " " "	98.27
" 1884 " " " "	101.33

Assuming that the absolute value of the above-mentioned collection of the necessities of life, measured in terms of human labor, remains invariable, and that it is the standard dollar which changes value, then we see that the latter did really appreciate between 1876 and 1880, but slightly depreciated between 1880 and 1884.

Another test is afforded by the price of a house, because, taking it altogether, it requires as much labor to build a house now as it did ten or twenty years ago. So far as I can learn, the cost of such a building is higher now than it was ten years ago, and has not diminished any for several years past. I conclude, therefore, that house-builders in general can, on the average, earn as many standard gold dollars now in a day as they ever did.

A third test is afforded by the rate of wages. Professor Hadley's 'Connecticut labor report' shows that in Connecticut the rate of wages was the same in 1885 as in 1880: hence Connecticut operatives earn as many gold dollars now as they did in 1880.

Up to the present time we have actually had the gold standard, since the value of our silver dollars has been kept up to that standard by restricting their coinage. Were we to make the coinage of silver free on the present basis, it would cause a sudden and disastrous fall of twenty per cent in the standard. It is clear to me that this should not be permitted. If any more silver is coined, each dollar should contain a dollar's worth of metal, as measured by the standard which has prevailed during the past ten years; that is, the dollar should contain about 520 grains of standard or 468 of pure silver. I think all parties might well agree on this policy for the present. But they should all unite in demanding the creation of a government commission, composed of men wholly above the ordinary influence of politics, to determine how the standard dollar is actually changing when compared with human labor, and to make known the results of their investigation from time to time.

SIMON NEWCOMB.

II.

THE so-called 'silver question' is one of the most complicated and difficult issues in our politics now pressing for solution. It has excited an immense amount of debate which has been partisan and ignorant, even beyond the ordinary run of political discussion. This arises from a number of circumstances, two of which are especially important; viz., (1) that the decision of the matter involves pecuniary interests of enormous extent, and (2) that some of the most important facts necessary to an intelligent decision are not attainable by any means now within our reach. The lack of accurate knowledge has led many to indulge in the most unwarranted flights of fancy, while the feeling that one line of action or the other might interfere with vested interests has lent the personal element so visible in all debates on the subject.

I can do but little, in the space accorded me, toward discussing the question in its broader aspect, and shall therefore limit myself to a criticism of some of the most common arguments advanced by those who oppose the re-establishment in this and other countries of the so-called double standard.

1. The attempt is made, by those who oppose the re-establishment of the so-called double standard, to cast a slur upon their opponents by representing them as quacks who desire to try dangerous experiments on the body of a healthy patient. This is very good rhetoric, but very poor science. It is only within about fifteen years that any general experiment has been made in the civilized world to substitute a single gold standard for the so-called double standard. Since that time it would seem as if there were but one phenomenon common to all civilized nations, and that is, commercial and industrial depression, — depression in which protection and free-trade countries, republics and monarchies, small and large states, manufacturing and agricultural communities, have alike shared. Labor difficulties, agricultural ruin, commercial decay, form the subject of numerous reports and commissions in all European countries. In a word, the patient is not in a healthy condition at all. In fact, it would appear, on a close examination, as if he were in a very bad way indeed; and it is not by any means clear that his present sad state is not greatly aggravated by the attempt which the gold doctors made some fifteen years ago to discard the treatment which had prevailed in this sphere for centuries previous. So far, then, from being open to the charge of wishing to make unnecessary experiments, the silver doctors may claim that they merely ask for a return to a course of life under which the industry of the world had developed up to 1870,

¹ The table on which this is founded is given in my Principles of political economy, p. 211.

and from which the gold doctors persuaded the world to depart at that time, with the unsatisfactory result now before us.

2. The attempt is also made to make the advocates of bimetallism in this country appear as favoring a breach of faith. This is, of course, a serious charge, and is deserving of careful consideration. We began in this country with the system of so-called double standard under which a man might pay his debts, either in gold at the rate of 24.75 grains of pure gold to the dollar, or in silver at the rate of 371.25 grains of pure silver to the dollar. This plan continued until 1834, when the amount of pure gold was changed to 23.20, and in 1837 to 23.22, silver remaining unchanged. It was expected, of course, that under this system the debtor would use the cheapest metal, and would pay in gold or silver, according as it was easier for him to get 23.22 grains of gold or 371.25 grains of silver in the form of dollars. This device was deliberately adopted in 1794, after full discussion, as being calculated to further the monetary and industrial interests of the country by keeping up the supply of money. It was continued without change until 1873. As a result of the change in valuation of the gold coin in 1834, it was cheaper for the debtor to pay his obligations in gold than in silver; and the latter metal disappeared from circulation, leaving a currency, so far as it was metallic, of gold alone, if we except the token-silver currency, which was a legal tender only to five dollars.

In 1873 this option of paying either in gold or silver was taken from the debtor by a modification of our coinage laws. About the same time the value of silver began to fall. Under a metallic currency, this would have led to the payment of debts in silver, if the law conferring the option of paying debts in either silver or gold had not been repealed in 1873. All debts contracted prior to 1873 had been contracted under this option. This option was a part of the contract; and the debtor had a perfect right to complain if the law interfered to take it away, and thereby practically increase the burden of his obligation. Legally speaking, then, the debtor had the right to insist that he should have the option of paying in silver; and all talk about the debtor trying to evade his obligations, or taking refuge behind the law, and therefore deserving reprobation, is not to the point. He is simply trying to do what our laws encouraged him to do up to 1873, with the idea that his taking advantage of the law would further all interests in the country by forcing a recourse to the cheaper metal when one of them became too dear.

The case is still further complicated by the fact

that the general demonetization of silver hastened its fall in price, thus widening the distance between the value of gold and silver. The creditor class pointed to this great disparity, which they had themselves increased by their influence in government, as a proof of the great injustice which would be done by continuing the option of paying in silver. The debtors answered, that, if they had been allowed to exercise the option which existed when the debt was contracted, this would have been done as soon as silver was the least bit lower than gold, and the consequent use of silver would have prevented its fall. The argument, so far as the case of creditor *vs.* debtor is concerned, may be considered about even. The creditor is always trying to induce the government to adopt a policy (i.e., to try experiments) which will increase the burden of existing obligations; and when any attempt is made to force the government to give up such a policy once adopted, the creditor indulges in much loud talk about the danger of experimenting with the currency, and interfering with vested interests, and frightening away capital, etc. The debtor takes the opposite ground exactly; and one may be set over against the other with the remark that the money-lending class has never been so distinguished for truth-loving or disinterestedness, that we are justified in accepting their statement of the case to the extent which is characteristic of our industrial society.

3. Looking at the question from the stand-point of the permanent interest of society as distinguished from the immediate relation of debtor and creditor, it is certainly not by any means proven that we have yet reached such a stage of economic development as would enable us to get along with gold alone in our currency. A persistent and continued fall in prices is the same disturbing influence in our social and industrial economy, whether it come from a scarcity of gold or a contraction of credit; to which latter cause some monometallists ascribe the late fall in prices. The attempt is made to cast a slur upon the 'silverites' by calling them inflationists, as if to be an inflationist were the greatest of monetary sins. It would seem to be a sin of the same kind, and of even greater magnitude, to be a contractionist, since a policy of slow contraction in the world's currency is certainly productive of far more harm to the world's economy than the process of slow inflation which might occur under the action of a so-called double standard.

It is agreed by most economists that the ideal money will be stable in value. Many economists think that by a double standard a greater fixity of value may be attained than by a single standard. The fluctuations may be more numerous, but will

not be so great. All agree that we have not yet found an ideal standard in this respect. Every material which has ever been adopted as money varies in value continually, either falling or rising, and thus causing a consequent shifting of property from the hands of one class to another, and practically producing the same results as a contraction or inflation of the money-supply. We must choose, then, between an appreciating or depreciating standard, between a policy of contraction or one of inflation. This is purely a practical question, and is one mainly of degree. A high degree of inflation may be more injurious than a low degree of contraction. But as between a ten per cent contraction, for instance, and a ten per cent inflation, of the world's metallic currency at the present time, I have no hesitation in giving it as my opinion that the former would be of enormously greater damage to our modern society than the latter. This is, of course, a very different question from that involved in the contraction or inflation of the paper currency of a single country.

A system of contraction, an appreciating world currency, means, under ordinary circumstances, a world-wide industrial depression. It means an increasing burden of debt, "the cherishing of a fortune made at the expense of a fortune making," the encouragement of the non-productive at the expense of the productive classes, the injuring of those who live by current labor for the benefit of those living on past labor, the giving to the past a firm grip on the throat of the present; it means, in a word, stagnation of business, idleness and poverty, to the full extent of the influence of changes in the currency on trade and industry.

4. It is claimed that such an inflation of the currency as would result from a return to the double standard would injure the wage-receiving class. There is little doubt that the laborers would be among the last classes in the community to adapt themselves to the inevitable change incident to an inflation of the currency. Wages would be among the last things to rise. Still there are worse things than a failure of wages to rise correspondingly to rise in cost of living; as, for instance, falling wages, and diminishing opportunity to receive any wages at all, which has been rather a characteristic of the last dozen years the world over.

5. It is sometimes said, that, if we are to go back to a double standard, we should at least take the market ratio now prevailing, and increase the amount of the silver in the dollar proportionally. This would not be advisable, for the simple fact that it is highly probable that much of the present depreciation of silver, if we allow that it has depreciated at all, is owing to the fact that it has been

discarded from the circulation. Restoring it to its old place by the side of gold will tend to restore its value, and to adopt the ratio now prevailing would be likely to prove a gross mistake. Neither a due respect for pecuniary obligations, nor a proper regard for the facts of history, would allow any such compromise.

6. Finally, we may say that the whole question is discussed too much from the supposed immediate effect of a restoration of silver, and not enough from its permanent tendencies. It is claimed that a return to a double standard will end in a commercial crisis, in which values will be enormously disturbed, and the whole industrial world will be thrown into confusion. Even if this be granted, it does not by any means prove that we should not return to the old system, since the evil effects of continuing the present policy may be infinitely greater. Stagnation of business, increase of burdens on the productive classes, by a continued appreciation of debts, are likely to prove more ruinous by far to national welfare than the speculation, disturbance of value, and scaling of debts, incident to the comparatively slight inflation which would follow a restoration of the silver standard, even at the old ratio, provided it were general.

E. J. JAMES.

III.

1. It was supposed by many people that the act of Feb. 28, 1878, by the terms of which the present coinage of silver dollars is continued, would keep up the price of silver, which by that year had fallen from the old and normal price of about 60d. per ounce (English standard, 37-40 fine) to 52 9-16d., indicating a change in the ratio of gold to silver from about 1:15.5 to 1:17.92. Of course, the Bland bill was not passed solely by congressmen who had this opinion,¹ since it was also advocated by inflationists and silver-owners. But I propose to address those who, without any improper or pecuniary interest involved, believe that the use of silver on a large scale by the United States is desirable. These are honest people, and deserve something else than invective. They believed that the action of the United States would aid somewhat in restoring the value of silver, and they felt, and still feel, that the disuse of silver was a great calamity to the vast world of industry here and abroad.

Now, what has been the effect on the value of silver, of the coinage of \$24,000,000 a year by the United States since 1878? Has it raised the value of silver? No, not in the least. On the contrary,

¹ I have given somewhat fully the reasons which brought about the passage of this act, in my *History of bimetallicism in the United States*, chap. xiii.

silver has continued to fall in price since our legislation, until it is now permanently selling at as low a price as has ever been recorded, even in the exceptional period of July, 1876. The lowest point ever reached in the silver panic of 1876 for a few days was 46 3-4d. per ounce; but since September, 1885, it has steadily remained about or a little below that point. In other words, silver has fallen about eleven per cent more since the act of 1878 was passed. The supposed effect of that legislation, then, has never been produced, and the act ought not to be retained on the ground that the coinage of \$24,000,000 a year can prevent the decline in the value of silver.

2. It will be said, however, by some, that this decline in the price of silver is a decline relatively to gold alone, and that since the values of articles other than silver have also fallen, relatively to gold, since 1873, we must declare that the value of gold has increased, and that the value of silver has not fallen. Now, no one can deny, that, when gold prices fall, the value of gold is increased: that has happened even when the supply of gold was rapidly increasing, as in the panic year of 1857. But I cannot think that there is any evidence to show that the fall of prices since 1873 has been due to the scarcity of gold, as has been asserted. If gold has greater purchasing-power owing to a fall of prices, that does not necessarily imply any conclusion whatever as to the scarcity of gold for the uses of trade. To say that, because prices rise or fall, there is a greater or less quantity of metallic money capable of being used, is, in my opinion, to commit a grave economic error. It certainly overlooks the practical business habits of the commercial world. While impossible to offer full reasons in so brief a paper in favor of my position, I can at least outline my ideas in a general way.

3. Prices at any given time are quite as much the result of credit as of the quantity of metallic money. As J. S. Mill said, "In a state of commerce in which much credit is habitually given, general prices at any moment depend much more upon the state of credit than upon the quantity of money." When credit in its various forms is expanded in a time of commercial activity just preceding a crisis, we all know to what great heights the prices of almost all articles can be carried. Purchasing-power in any form, whether money or credit, is used to buy goods, and is not caused by the existence of a few speculators, but by the state of mind throughout the community. And we know also, that, when the crisis comes, prices fall irrespective of the quantity of money. Of such changes, however, an objector might say that they are temporary, while the fall of prices since 1873 has been so prolonged that it cannot be due to

temporary causes. But varieties of credit-devices, by which goods are exchanged against each other without the use of metallic (or even paper) money, continue in permanent use. I can only mention one of these by way of illustration, — the check system. Receiving \$10,000 in money, as a manufacturer of cotton goods, I deposit it to my order in a bank. When I want to pay B for raw cotton, I send him a check for \$10,000. B now owns the right to draw the deposit, and he pays C by a check for \$10,000 for machinery; and D and E follow the same method of payment. During this procedure no money has been drawn, but the deposit served as the basis for transactions to the amount of, perhaps, \$50,000 or more. The check, as a credit-device, was purchasing-power, and, when offered for goods, affected prices as much as the offer of gold would have done; and, as transactions increase with the growth of wealth and population, goods are exchanged for each other without the use of money by such devices as the check and clearing-house system, through the aid of banks, to a surprising amount. In New York alone, goods are exchanged for each other annually through the clearing-house, of a value much greater than that of the whole national debt of the United States (the sum exclusive of clearing-house balances, which are paid in money), without the use of a single cent of money, either gold, silver, or paper. This shows, briefly, how absurd it is to suppose that the amount of gold ought to increase in proportion to the increase of population or wealth: for in prosperous years the clearings increase; that is, the more the goods to be exchanged, the more the system is used. I cannot have space in this paper to discuss this in full, nor refer to the prevalence of the system on the continent of Europe.

What I wish to illustrate is, that the level of prices depends, not solely on the quantity of money, nor on credit, but on both combined, and that a change in prices does not imply a change in the quantity of money. I have referred only to checks. There are many other forms of credit in constant and general use, such as bills of exchange, paper money, and book credit (or 'trust,' as it is sometimes called in retail buying), and all have a great influence on prices. If prices fall, that single phenomenon, therefore, does not convince me that gold is scarce; and I do not see how it can convince anyone else.

4. There is good evidence, moreover, to show, that, in the period when it was claimed that gold was appreciating because of its scarcity, there was no lack whatever of gold. This is to be found in the rate of discount at the Bank of Eng-

land and at the great banks of the continent. As every banker knows, whenever there is an evident disposition to draw gold from the bank reserves of Europe, the withdrawals of specie lower the proportion of the reserves to the immediate liabilities (which are, except at the Bank of France, chiefly deposits). This alteration requires such an increase in the rate of discount as will ward off some of the demands for new loans, and allow the stream of maturing loans to fill up the reserves. The rise in the bank-rate is an evidence of a fear that the gold reserve is too low, or may fall too low. The London financial market is the chief one of the world, and the Bank of England rate is its sensitive barometer. What were the facts? In the four years from 1874 to 1877 (inclusive), during which year silver fell so exceptionally, the rate of discount at the Bank of England averaged 3 1-8 per cent. There was no evidence whatever of a difficulty on the part of any great bank in keeping a plentiful supply of gold in its cash reserves; and yet during this time Germany was supplying herself with \$400,000,000 of gold to carry out her currency reform, and France was accumulating about \$180,000,000, in addition to her previous stock, in order to resume specie payments (Dec. 31, 1877).

It may be said in reply that the rate of discount does not depend on the supply of money, but on the supply of loanable funds. This, in the long-run, is true; but if, during this period, there had been any scarcity of gold, any deficiency of the quantity in comparison with the demand for it, it is inconceivable that during the process of 'grasping' for it there should have been no serious change in the rates of discount.

5. Not only does there appear to be no evidence of a scarcity of gold since 1873, as shown by the absence of any difficulty experienced by the banks in collecting and keeping sufficient reserves (while in the United States never in the history of the national banks have they held larger gold reserves than of late), but the facts of the production of gold since 1850 give every reason to suppose that there is an abundance now in existence. The facts of production may be briefly summed up as follows:—

[000,000 OMITTED.]

Period.	Gold.	Per cent.	Silver.	Per cent.
1493-1850	\$3,314	43.9	\$6,742	74.4
1851-1883	4,233	56.1	2,318	25.6
Total	\$7,547	100.	\$9,060	100.

It will appear from this that in the 33 years since 1850, and to 1884, not only was the produc-

tion of gold equal to all that produced in the 358 years from the discovery of America to 1850, but it was even greater by almost a third. And it is more than probable that the existing stock¹ in 1848 was not only doubled, but one-half more than doubled. To 1840 the annual production of gold was about \$14,000,000, roughly speaking; in 1841-1850, \$38,000,000; while in 1881-1884 it averaged about \$100,000,000. In the exceptional years between 1850 and 1860 the production was greater than it is now; but it is still two and a half times what it was in 1848.

In short, there is not the least doubt in my mind that this very abundance of gold was the cause of the fall in the value of silver. Both metals being in use for money, when the better became more plentiful, it drove the poorer out of use,—just as steel rails are driving out iron rails on our railways,—because gold is a better and more reliable tool of exchange than silver. On the ground, therefore, of a scarcity of gold, there is no reason whatever, in my opinion, why the coinage of silver should be continued. The theory that there is a vacuum created by the lack of gold, and which must be filled by the coinage of silver in order to prevent prices from falling, is certainly not tenable.

6. The fall of prices can be explained by causes wholly independent of the quantity of gold in existence, and connected with the contraction of credit, the fall of profits due to increased competition in certain branches of industry, large production, and the introduction of new processes and improved machinery; and, unless it were absolutely certain that the silver men were correct, it would be a bold and unwarranted act of theirs, on the basis of a mere fanciful supposition in regard to the dearth of gold, to experiment on the finances of a great country when a blunder might involve disaster to our whole business prosperity. To lead us to a single silver standard, on the mere theory that gold has 'gone up,' is a piece of statesmanship which should be treated with unequivocal condemnation. Even before we come to the single silver standard, the uncertainty in regard to what the future may bring forth, caused by the continued coinage of silver dollars, is injurious to all legitimate business calculations. Uncertainty and distrust destroy all initiative. The silver-money doctors are dealing with a very complicated organism, and, if their diagnosis is incorrect, persistence in their rude treatment will be of serious damage to the financial body.

J. LAURENCE LAUGHLIN.

¹ Newmarch estimates the existing stock in 1848 at \$2,716,000,000 of gold, and \$3,880,000,000 of silver. Such estimates, however, are only of the nature of guesses: there is nothing accurate about them.

THE SENSE OF TOUCH, AND THE TEACH-
ING OF THE BLIND.

THE sense of touch is one of the most complex which we possess, and one not well understood. Recent physiological studies have shown its independence of others that have long been associated with it. The senses of heat, cold, pain, and touch, bear intimate relations, but nevertheless are distinct; and a more perfect knowledge of their different phases must lead to a better understanding of many peculiarities among the blind.

Professor Soret, says the *Spectator*, taking up the psychological branch of the subject, has tried to find out how far the sense of touch may be made to convey to the sightless an idea of the beautiful: for as a deaf musician may enjoy music despite his deafness, so may a blind man find pleasure in beauty of form notwithstanding his blindness. In the one case, the pleasure comes from the rhythm, or rather from sonorous vibrations in the air, produced by the playing; in the other, from the symmetry and regularity of the object handled. "When music is going on, I feel something here," said to M. Soret a deaf-mute who enjoyed operas, putting his hand on his stomach. The blind, even those born blind, as Professor Soret has ascertained by inquiries among the inmates of the blind-asylum of Lausanne, have the same love of symmetry as the deaf. The girl-embroiderers attach much importance to the perfect regularity of the designs which they are required to repeat in their work. The basket-makers insist on the willow withes they use being all straight and of the same length. Imperfections in the things they handle are, to the blind, indications of ugliness. They like evenness of surface, and regularity of shape: a cracked pot, a rough table, or a broken chair causes them positive discomfort.

But to create in the mind of a person born blind an artistic idea, involves a measure of psychological development which it is very difficult to impart, and requires from both teacher and scholar great patience and long-sustained effort. The imagination,—the faculty of representation, as it has been called,—though partly inborn, is much more the result of a long series of automatic experiments in which all the senses co-operate, mutually controlling and correcting each other. This faculty is naturally less developed with the sightless than the seeing. If even many educated people, who from their youth upwards have been reading books and seeing pictures, find it hard to realize to themselves scenes they have never beheld, how much harder must it be for the blind to identify this or that outline

with beauty, or the reverse! At the sight of a picture or a design, we straightway and without effort represent to ourselves the object delineated in all its three dimensions. It never occurs to us to think that the horse, or the man, or the mountain, is nothing more than a combination of colors laid on a flat piece of canvas. The mere feeling of a picture, albeit in relief, cannot convey the same impression as an ordinary painting; for, to the blind, perspective and foreshortening must be mysteries so profound as to be hardly capable of comprehension. Nevertheless the difficulty is not insurmountable. Professor Soret mentions the case of a blind rustic, accustomed to horses, who, without help, succeeded in selecting from a number of other designs, in relief, the figure of the animal with which he was most familiar. A youth of quick apprehension, and vivid though undeveloped imaginative power, he had handled horses in his father's or his master's stable until he had mentally created an ideal horse so like the original, that he was able to recognize by his fingers its counterfeit presentment. Another boy, born blind, but thoroughly educated, was able to pick out a bird; yet he admitted, that, unless he had previously handled a stuffed specimen, he would have had great difficulty in identifying the figure, and realizing what the original was like. In other words, mere description is not enough: a blind man cannot mentally see a thing, or even recognize it when laid in a touchable form before him, unless he has first familiarized himself, by actual experience, with its outward shape.

It would thus seem that the faculty we call 'imagination' depends nearly altogether on the sense of sight. If we have seen a hill, we may have an idea of what a mountain is like; by seeing a lake, we get a notion of the sea: but, if we never saw either a tree or the picture of one, not all the word-painting that was ever penned would convey any true or adequate idea of an ordinary wood, much less of the wondrous beauty and bewildering grandeur of a tropical forest. We should be so far blind; and the blind can image to themselves only that which they can feel with their hands. All the same, thanks to their innate love of rhythm and regularity, they can be taught, through the sense of touch, to appreciate shapeliness, to find an aesthetic pleasure in sculptures, in certain of the decorative arts, and in raised pictures. They may even learn not only to recognize their friends by feeling their features, but to single out a pretty woman and a handsome man. As to this, Professor Soret relates an amusing and suggestive anecdote. Some time ago, three professors made a visit to the Lausanne asylum. One was a stalwart and handsome Swede, with a

splendid head; the second, an exceptionally ugly Swiss, with a head 'that left a good deal to be desired;' the third, an average mortal of ordinary appearance. Among the inmates of the asylum was a poor deaf-mute of the name of Meystre, blind from his birth, but highly impressionable, and quick to distinguish between shapes that conformed to his ideal of the beautiful and those that did not. The feeling of a deformed or mutilated man, for instance, would sometimes draw from him signs of compassion and sympathy; at others, strange grimaces and mocking laughter. On being told to examine the three visitors, Meystre showed great admiration for the Swede; but, on passing to the Swiss, he seemed greatly amused, indulged in his usual mocking laughter, and by his gestures made it understood that he thought the man had no back to his head, which he seemed to consider an excellent joke. The result of the third examination was negative. It produced no sign either of satisfaction or displeasure.

These facts seem to show, and in Professor Soret's opinion prove beyond a doubt, that, so far as the 'human form divine' is concerned, the blind possess the same ideal of beauty as those who see, and that this ideal is innate; and he is anxious that those who have charge of the sightless should make every effort to cultivate their aesthetic taste; that by means of cardboard models in relief, and other expedients, they should be familiarized with the highest types of human beauty, which occupy so large a place in all literatures. By this widening of their conceptions, they would be enabled to understand allusions and descriptions in poetry and elsewhere, which at present they must find utterly incomprehensible. The better to accomplish this object, Professor Soret has drawn up a complete programme; and seeing how hard life is for the blind, and from how many pleasures they are debarred, we may heartily applaud this effort to ameliorate their sufferings by opening to them new horizons, and wish it every success.

PUBLIC HEALTH IMPROVEMENT IN ENGLAND.

THE death-rate in England and Wales in 1885 again fell, says the *Lancet*, to 19.0 per 1000 of the estimated population, and excepting only the year 1881, when it was 18.9, was lower than in any previous year since civil registration came into operation in 1837. The registrar-general's quarterly return, relating to the last three months of 1885, calls attention to the fact that the death-rate in each of the five years 1881-85 was considerably lower than the rate recorded in any year

prior to 1881. The mean rate in the first half of the current decennium (1881-90) did not exceed 19.3 per 1000, showing a further decline from 20.8, the mean rate in the preceding five years 1876-80; whereas, in the preceding forty years of civil registration, the mean annual death-rate was 22.3, and the lowest rate in any quinquennium was 21.4 in 1841-45. This marked reduction in the English death-rate has now been maintained for ten years, and has been much greater in the second than in the first half of that period. It cannot, in the interest of further health progress, be too constantly borne in mind that the commencement of this period of reduced death-rate was coincident with the coming into full operation of the public health acts of 1872 and 1875.

The effect of this reduced death-rate upon the numbers and longevity of the English people is phenomenal. The registrar-general points out that the reduction in the last five years implies that "more than 281,000 persons in England and Wales survived that period, whose deaths would have been recorded had the mean rate of mortality been equal to that prevailing in the ten years 1871-80," in the latter half of which period the improvement in the public health had already set in. With regard to the increased longevity of the population, Mr. Noel Humphreys, in a paper read before the Statistical society in 1883, showed that the effect of a reduction in the mean death-rate from 22.5 in 1838-54, to 20.8 in 1876-80, would be to add two years to the mean duration of life of every male, and three years and a half to that of every female born.

PROFESSOR GRABER has made an extensive series of experiments on the degree and localization of the sense of smell in insects, etc., from among the results of which the following will be found of interest (*Journ. roy. micr. soc.*). Odors are perceived by many invertebrates, such as mollusks, insects, etc., with extreme rapidity, sometimes in one-third of a second, and even through an intervening layer of water a half-millimetre in thickness. This sensitiveness is very much greater than was exhibited by the vertebrates experimented upon (reptiles, birds). Insects deprived of their antennae are still able to smell, but in varying degrees in different insects and for different odors, some fine odors being apparently perceptible only through the antennae. Perception of smell through the stigmata or respiratory organs is not rapid nor important, though such has often been maintained. In some cases the palpi of the mouth-organs are more sensitive than the antennae, and therefore the latter cannot be considered as being alone the organs of smell.